**Letter of Transmittal**

To: Senior Leadership

From: Kristofer Bitney  
Re: Project Proposal  
Date: June 11, 2020

The purpose of this letter is to introduce the attached document, which proposes an implementation strategy for a new type of service our division can provide our customers. The service is known as “photo colorization”. Photo colorization is the practice of adding color to grayscale photos, such as photos taken before the invention and adoption of color cameras. I believe this service can increase customer satisfaction, attract new customers, and ultimately be profitable to our organization.

The proposal broadly outlines a software engineering plan to develop an application that colorizes photos automatically and cost-effectively. The application is based on statistical modeling methods from the field of “deep learning”, a subfield of machine learning. We can host the application as a web service, accessible to customers or employees from popular web browsers on desktop and mobile devices.

From planning through deployment, the software development lifecycle will take about three months to complete for one developer with adequate expertise in the relevant areas of computer science. The cost of the project will be approximately equal to the cost of a single developer’s salary during the three months of development, plus post-deployment maintenance and server hosting costs.

The benefits of the project will easily outweigh its costs. The project will appeal to an aging customer segment who have retained photo albums from their childhoods. Millions of Americans own photos of family members from the early-mid 20th century, before color cameras were available. Because development costs are so low, increased customer satisfaction from providing photo colorization as a free service may alone be enough to justify the business case for this product.

I hope you enjoy reviewing the attached project proposal. I welcome feedback, and hope that this proposal inspires new ideas and opportunities.

Thank you,

Kris Bitney

**Project Proposal: Photo Colorization Application**

**Introduction**

Our photo restoration products attract a variety of customers, from families with cherished memories to photography hobbyists. A significant demographic in our customer base are the aging and elderly population who seek to maintain the quality of old photos. Family photo albums can have personal and emotional value to our customers due to the role of albums as records of a time before digital photography and mobile phone cameras were ubiquitous.

Color photography became accessible to the average American household in the early 1960s. Earlier photos were grayscale, also known as “black and white”. The aging segment of our customer base often own grayscale photos. This presents a market opportunity for photo colorization services.

**Photo Colorization**

Photo colorization is the process of adding color to a grayscale photo to replicate what the photo would have looked like had it been taken with a color camera. Photo colorization is a relatively new process that has become more widely available during the last decade as machine learning technologies have improved. Before “deep learning” algorithms, photo colorization was a manual process. Today it is possible to colorize photos quickly, cheaply, and with a high level of realism.

**The Photo Colorization Application**

I propose we develop and deploy a photo colorization application. The application would use modern deep learning model architecture and algorithms to colorize grayscale photos. By hosting the neural network on a web server, we can make the service accessible from common web browsers. The final product would involve:

* A neural network
* A web server
* A user-facing web page

The service would be easy for employees or customers to use. Users must first scan their physical grayscale photos and save digital copies onto their devices. Once a user has a digital copy of a photo, they could navigate to the web page we develop and immediately see two buttons. One button would be used to select the photo they wish to colorize, while the other colorizes the photo and pushes the result to the user. In summary, the application would require only two button clicks from the time a user navigates to our web page. Additional steps may be required should we wish to integrate the service with other products or require users to log in before access is granted.

To develop the neural network, we need a dataset to “train” the neural network model. Large, publicly available datasets of photo images are abundant. I recommend use of the Common Objects in Context (COCO) dataset, which contains well over 100,000 photos of people, animals, objects, and environments. The diversity of the dataset—and its permissive licensing—make the dataset amply sufficient and appropriate for use in a photo colorization product.

The COCO dataset is distributed under a Creative Commons Attribution 4.0 License. Use of images must abide by the Flickr Terms of Use. We must cite the COCO dataset in our publications to indicate it was used. Copyrights of the images in the dataset are owned by a large number of individuals who have permitted inclusion of their images in the dataset, so the images themselves should not be sold in association with our photo colorization product. We would retain copyright of our neural network model and application.

**Software engineering methodology**

I recommend a Waterfall project management model for development of a photo colorization application. The Waterfall model approaches project management in a traditional manner, linearly flowing through the following steps:

1. Requirements Analysis
2. Design
3. Implementation
4. Verification
5. Deployment
6. Maintenance

The Waterfall model works well for small projects that are well-understood. The photo colorization application can be developed by one individual who is proficient in statistics, deep learning methods, front-end web development, and back-end web development. I can develop this application using popular and free programming languages and frameworks.

**High-level schedule and budget estimates**

The full software development life cycle will take approximately three months to complete for a minimally viable product, from planning through application deployment. Application maintenance would be ongoing once the application is deployed. The rapid rate of progress in the field of deep learning suggests potential product improvements will become increasingly available, creating some degree of uncertainty about competition-driven incentive for additional development in the future.

I recommend a small project budget that covers the salary of a single developer for the three month project schedule, a basic subscription plan for the use of GPU compute services for three months, monthly server hosting costs, and any additional costs associated with features requested in the future. The combined cost of GPU compute and server hosting services will be about $15 per month during development. Server hosting costs will be as low as $7 per month following deployment. As our photo colorization service grows in popularity, server hosting costs may increase to accommodate more internet traffic.

**Conclusion**

A photo colorization application can increase customer satisfaction and attract new customers to our business. We have the expertise and resources to develop the product. Development costs are so low that we can offer photo colorization services to our customers inexpensively or free of charge, and with little financial risk to the company.